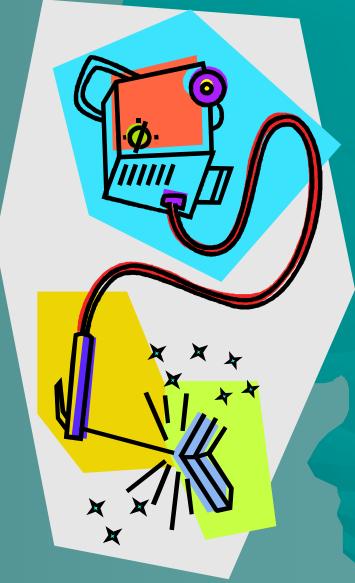
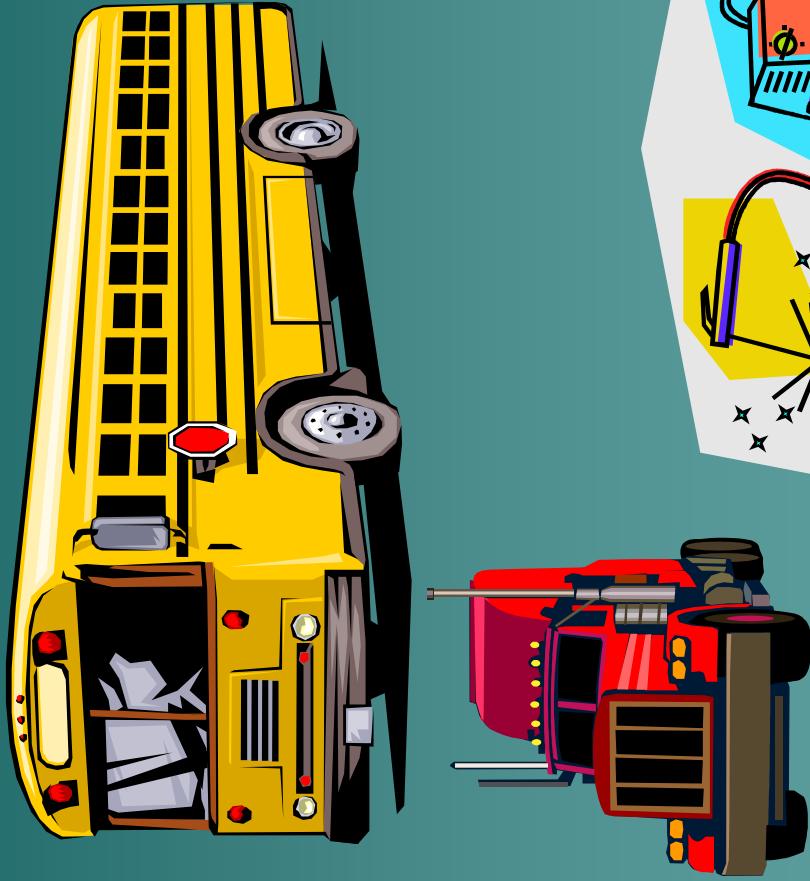


Diesel Exhaust Emissions

- ◆ Health impacts
 - Respiratory
 - Cardiac
 - Cancer
- ◆ Air Quality impacts



Diesel Exhaust – Complex Mixture

- ◆ Two main categories of diesel exhaust:
 - Gases – non-toxic and toxic components
 - Particles – fine and ultrafine and toxic chemicals absorbed onto them

Health Hazards from:

- ◆ Acute (short-term) exposures
- ◆ Chronic (long-term) exposures resulting in non-cancer effects
- ◆ Long-term exposures resulting in lung cancer

Exhaust irritates airways

- ◆ The bulk of the studies show impacts on the respiratory system resulting in short-term effects of:
 - Eye, throat, lung irritation
 - Increased cough, phlegm production
 - Triggering asthma attacks

Chronic (long-term) effects

- ◆ Longer exposures can lead to inflammation of and microscopic changes to lung tissues, leading to reduced lung function
- ◆ Co-exposure to diesel and ragweed pollen increases allergic response

Signs and symptoms of exposure

- Increased airway resistance
- Inflammatory airway changes
- Increased susceptibility to infection
- Reduced lung function
- Nausea
- Lightheadedness

Cancer Risk – Diesel Exhaust

- A number of Federal and State organizations have determined that diesel exhaust is likely a human carcinogen.
- Detroit Air Toxics Initiative (DATI) report:
 - listed diesel with a *roughly estimated* cancer risk of 300-600 in a million in the Detroit area
 - (caveats – monitoring uncertainty and risk estimation uncertainty)

Why are kids at risk?

- ◆ Children are more susceptible to air pollution than healthy adults because their respiratory systems are still developing, they have faster breathing rates, narrower airways, and less mature immune systems

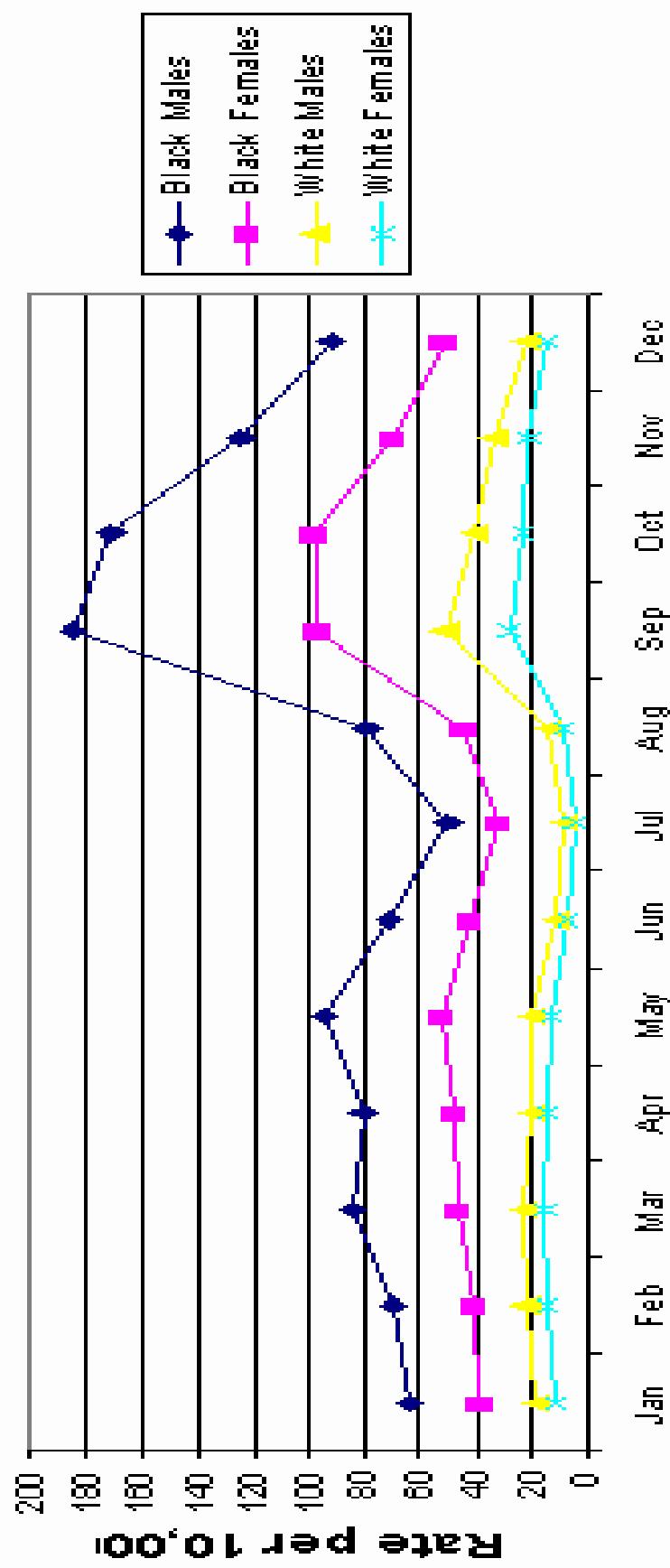


Children and asthma

- ◆ Asthma has a large impact on children in the United States each year. In school children, asthma is the *number one cause of absence due to chronic disease.*
- ◆ Asthma in preschoolers has risen 160% since 1980; in children 5-14 it has increased 75%

Asthma hospitalization rates go up in the fall

Childhood Asthma Hospitalization Rates By Month, Race, and Sex
Ages 1-14 Years, Michigan, 1990-1998

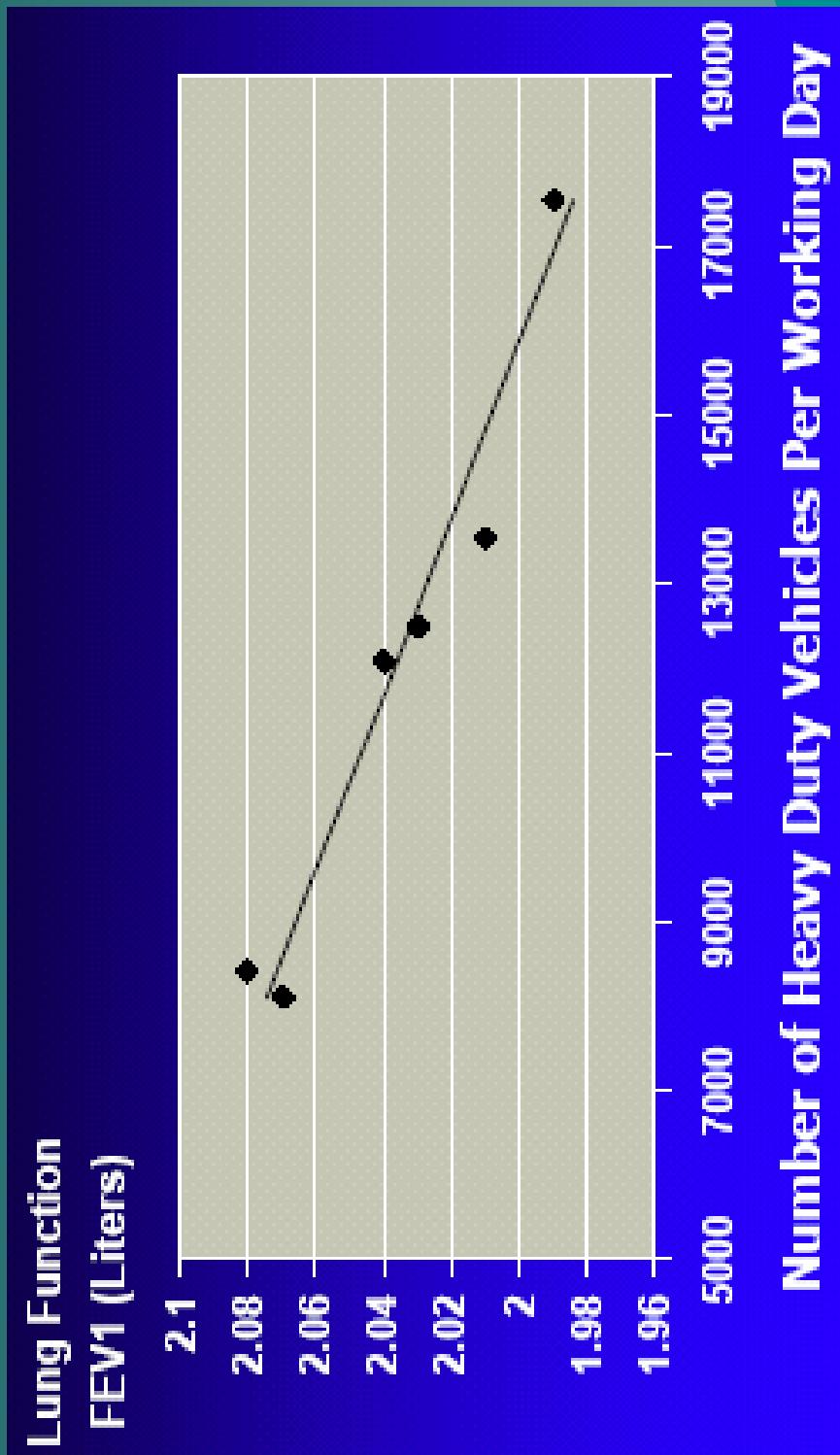


Special Risk for Children from School

Buses

- ◆ On average, children spend more than an hour on a school bus each school day as well as time waiting for and getting on and off the bus. This increased potential for exposure and children's higher rates of respiration may lead to higher exposure to diesel exhaust in children. They are less likely to be able to expel or detoxify pollutants since their immune systems are immature.
- ◆ PM2.5 concentrations measured on buses have been found to be 5-10 times higher than average levels measured at fixed site monitoring stations.
- ◆ Smaller particles can penetrate children's narrower airways and are more likely to be retained there.
- ◆ When children's airways are inflamed or constricted by asthma, allergies or infections, diesel exhaust may make breathing more difficult

Living Within 300 Meters of Local Roadways Affects FEV₁



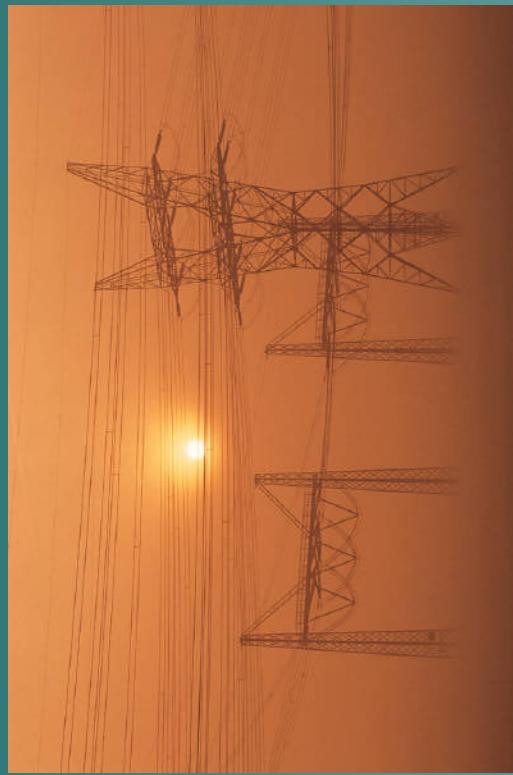
Brunekreef et al., 1997

Cardiac impacts from Diesel

- Associated with cardiac abnormalities
 - ◆ Both gas and particulate components
- Linked with blood component changes.

Diesel emissions contribute to:

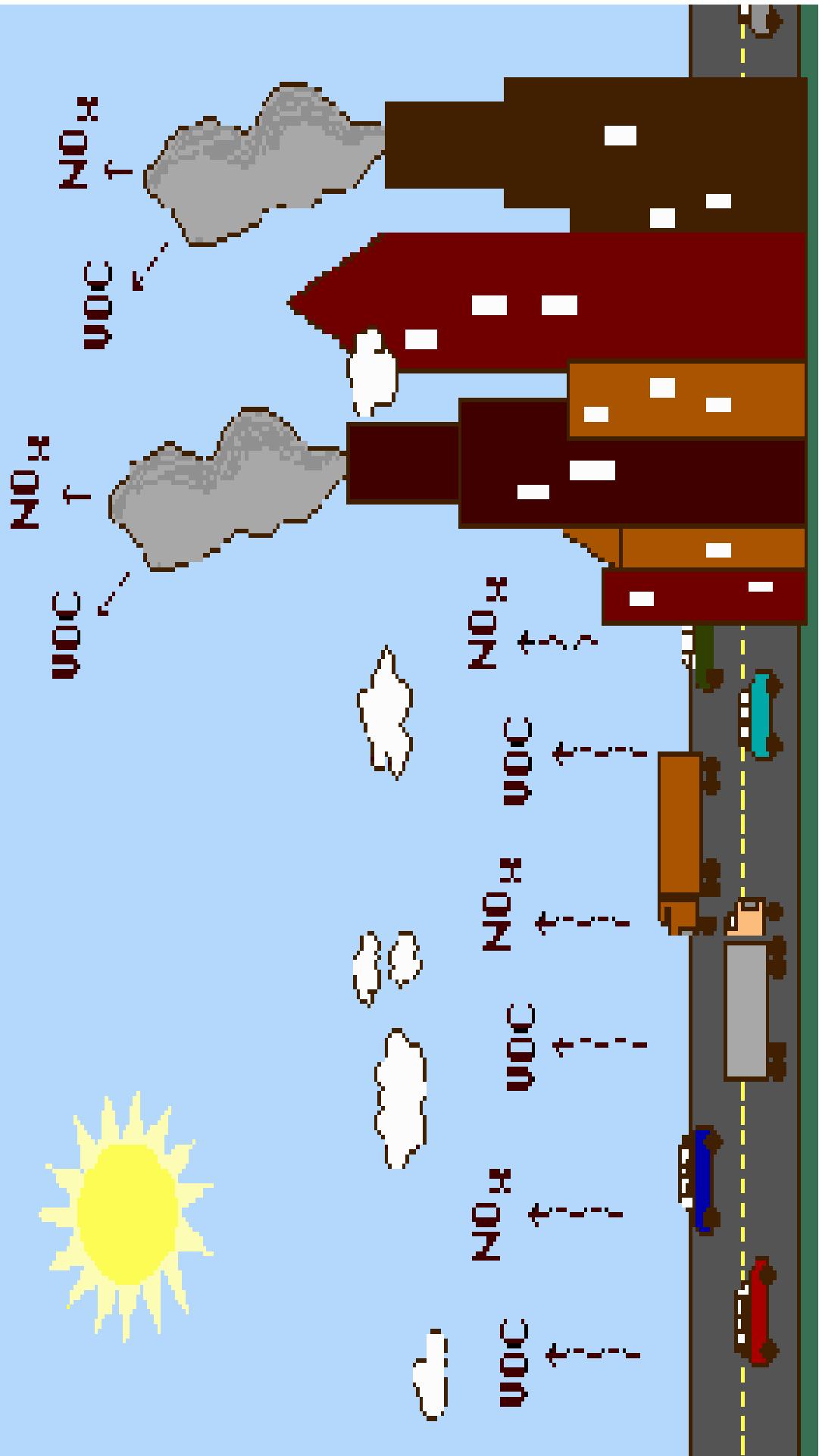
- ◆ Ozone (NOx) – contribution to smog formation
- ◆ Particulate Matter (especially PM2.5)
- ◆ Air Toxics



Risk from Diesel with other chemicals

- ◆ Exposure to tobacco smoke makes heart and lungs more susceptible to diesel health effects
- ◆ Exposure to other workplace or hobby chemicals may also have an impact on the toxicity of diesel exhaust

$\text{NO}_x = \text{NO}_x + \text{H}_2\text{O}$
+  + $\text{NO}_x + \text{VOC} + \text{CO}_2$



Ozone – Atlanta traffic /Asthma

•Atlanta, GA, 1996 summer Olympic games: changes in transportation and commuting behaviors reflected in lower O₃ levels and asthma admission rates¹

1. Friedman et al., 2001

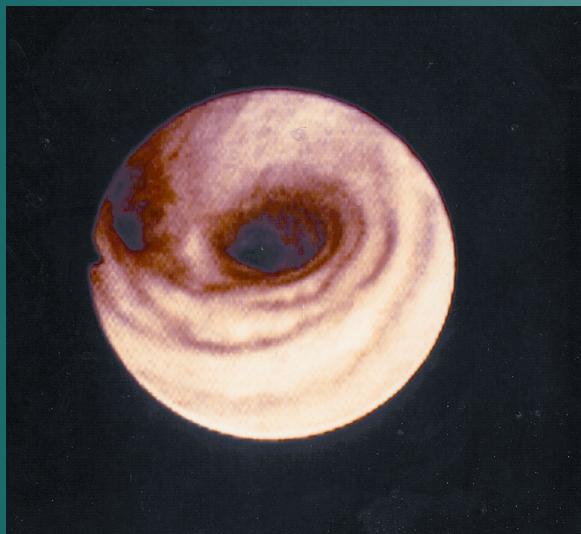
Particle Pollution Affects the Lungs

You are exposed to particle pollution simply by breathing polluted air.

Exposure increases when you exercise, because you breathe more vigorously and deeply than usual.

Respiratory effects include:

- airway irritation
- cough
- phlegm
- decreased lung function
- airway inflammation
- asthma attacks
- bronchitis
- chronic bronchitis



Impact On Air Quality

- ◆ According to EPA, Diesel Exhaust is estimated to make up 6% of the total ambient PM2.5 nationwide, with higher amounts in urban areas (10-36% in some Southwestern states)
- ◆ Composition varies with:
 - Type of engine
 - Fuel composition
 - Emission controls on the engine
 - Temperature

Extensive Literature

Some References:

USEPA, Health
Assessment
Document for Diesel
Engine Exhaust,
2002, 670 pg
www.epa.gov

Health Effects
Institute, Diesel
Emissions and Lung
Cancer, 1999, 71 pg.



Air Quality Index

Descriptors	Cautionary Statement
Good 0 – 50	No message
Moderate 51 – 100	Unusually sensitive individuals
Unhealthy for Sensitive Groups 101 - 150	Identifiable groups at risk - different groups for different pollutants
Unhealthy 151 - 200	General public at risk; sensitive groups at greater risk
Very Unhealthy 201 - 300	General public at greater risk; sensitive groups at greatest risk